Group Art Unit: 2878
Examiner: Lee, S.

Atty. Ref.: H 2182

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants : Martin Klein et al.

Appl. No. : 10/047,556

Filed : October 23, 2001

For : DETECTOR

MS Appeal Brief-Patents
Commissioner for Patents
P.O. Box 1450
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BRIEF ON APPEAL

Sir:

The Final Rejection of claims 1-3, 5, 6 and 8-14 has been appealed. This Brief is submitted in triplicate and in furtherance of that Appeal. It is urged that the rejections of claims 1-3, 5, 6 and 8-14 be reversed and that the appealed claims be allowed.

I. Real Party in Interest

The real party in interest is Universität Heidelberg.

II. Related Appeals and Interferences

There are no related appeals or interferences.

III. Status of Claims

All of the claims pending in the application have been finally rejected. Claims 1-3, 5, 6, 8, 11, 13 and 14 were finally rejected under 35 USC 103(a) as being

obvious over Danielsson et al., U.S. Patent No. 6,429,578 considered in view of Sauli, U.S. Patent No. 6,011,265.

Claims 9, 10 and 12 were finally rejected under 35 USC 103(a) as being obvious over Danielsson et al. in view of Sauli and considered further in view of Gleason, U.S. Patent No. 3,956,654.

IV. Status of Amendments

An Amendment After Final Rejection was filed and was entered for purposes of Appeal.

V. Summary of Invention

The invention relates to a detector for detecting electrically neutral particles, namely, neutrons (paragraph 0008, lines 1-3). The detector has a housing and at least certain regions of the housing are filled with a counting gas (paragraph 0037, first sentence). The detector also has a multiplicity of converter devices arranged in a cascade form (paragraph 0012, first sentence). Each converter device has an insulator layer coated on opposite first and second sides with first and second conductive layers (paragraph 0040, lines 17-20; elements 28 and 30 in FIG. 3). Each converter device also has a converter layer coated on one or both sides of the converter device (paragraph 0040, lines 8 and 9; element 24 in FIG. 3). As shown in FIG. 3, the converter layer 24 defines the outer-most part of the respective converter device. The detector further includes at least one readout device (paragraph 0042, first sentence) and at least one electrical drift field device for generating an electrical drift field for the electrically charge particles (paragraph 0039).

At least some of the neutrons which are to be detected are absorbed by the converter layers of the converter devices (paragraph 0047, first sentence). After absorption of the neutron in the converter layer, a nucleus in the converter layer breaks down to produce an α-particle that moves away from the remainder of the nucleus (paragraph 0047, lines 5-12). At least one of these conversion products will move away from the converter layer and will iodize the counting gas (page 29, first sentence). As a result, free electrons are generated in the counting gas (page 29, second sentence).

The charge cloud of the primary electrons is pulled towards the readout device by the electrical drift field applied between the drift electrode and the readout device (paragraph 0048, lines 4-7). Some of the generated electrons pass through one or more of the conversion devices to reach the readout device (col. 0048, lines 7-10). The converter device is of charge-transparent design (col. 48, lines 10-11). Thus, the primary electrons reach the readout device without losing their position information (paragraph 0048, lines 12 and 13). As a result, conclusions can be drawn as to the location of the ionization of the counting gas and the location of absorption of the neutron which is to be detected. (paragraph 0048, last sentence). The cascade arrangement of the above described and claimed converter devices enables the interaction surface area available for the electrically neutral particles to be increased enormously and therefore enables the detection sensitivity to be increased considerably (paragraph 0012, last sentence). The efficiencies levels are explained, for example in the last two sentences of paragraph 0054.

VI. Issues

The issues presented for review are whether the invention defined by claim 1-3, 5, 6, 8, 11, 13 and 14 is obvious over Danielsson et al. considered in view of Sauli and whether claims 9, 10 and 12 are obvious over Danielsson, Sauli and Gleason.

VII. Grouping of Claims

It is believed that each of the independent claims 1, 11, 13 and 14 presents different issues and should not rise or fall together. Additionally, it is believed that dependent claims 9 and 12 must be considered separately from their respective independent claims and dependent claim 10 also must be considered separately.

VIII. Argument

The claims define each converter device as having an insulator with opposite first and second surfaces. Each converter further has first and second conductive layers disposed respectively on the first and second surfaces of the insulator layer. Each converter then has a converter layer arranged on at least one of the first conductive layer and the second conductive layer to define an outer part of the respective converter device.

The final rejection is based upon the hypothetical combination of Danielsson et al and Sauli. The Danielsson et al. reference teaches a detector having a conductor-insulator-converter-insulator-conductor arrangement. The Examiner acknowledged that this Danielsson et al. arrangement does not suggest the claimed converter device. However, the Examiner turned to Sauli, which has a converter layer on the outside of one of the metal layers. The Final Rejection asserts that it would be obvious to combine Danielsson et al. and Sauli.

The Final Rejection requires a complete reconstruction of the Danielsson et al. detector as shown bellows:

Danielsson et al.
Conductor
Insulator
Converter
Insulator
Conductor

Appealed Claims
Converter
Conductor
Insulator
Conductor

The Board will appreciate that this is a very substantial rearrangement of Danielsson et al. Accordingly, the references relied upon in the Final Rejection presumably would require a very explicit incentive to motivate the skilled artisan towards this major reconstruction of Danielsson et al.

It is submitted that nothing in Danielsson et al. or Sauli would motivate the skilled artisan to make the hypothetical reconstruction and recombination that would be required to support the Final Rejection. In particular, Danielsson et al. is directed to a detector for detecting high energy x-rays (MeV) that can penetrate through thick material. Danielsson et al. discloses that the converter layer 708 has a thickness of about 150μm, which is at least one order of magnitude thicker than the top metal layer 704 of 5μm. The Danielsson et al. structure of a top metal layer being deposited on the insulator layer is known from conventional GEM structure (col. 11, lines 3-8).

Sauli, on the other hand, relates to a device for detecting primarily low energy particles or radiation. Accordingly, the Sauli converter layer is very thin and has a thickness of only a few μm. This Sauli arrangement of layers is required so that low energy particles or low energy radiation can reached the converter layer and such that secondary electrons generated by the converter also can leave the converter layer.

Danielsson et al. requires the converter to be in the center of the detector because Danielsson et al. is detecting high energy x-rays. Sauli, on the other hand requires the converter to be outer-most layer because Sauli is constructed only to detect low energy particles or radiation. As a consequence, due to the different fields of application of the detectors of Sauli and Danielsson et al., the person skilled in this art would not be motivated to combine the two teachings.

It is submitted that even if a skilled artisan was familiar with both Danielsson et al. and Sauli, that hypothetical person would not be motivated to complete the extensive reconstruction of Danielsson et al. in view of the Sauli teaching. In particular, the Danielsson converter layer 708 is arranged in the center of the five layer structure, and is covered by two layers of material on either side, namely, the insulator layers 706, 710 and the metal layers 704, 712. The converter layer 708 is well protected from secondary ions. Arranging the converter 708 of Danielsson et al. on the outer-most part of the converter device would allow damage to the converter layer. The skilled artisan would not be motivated to reconstruct Danielsson et al. in a way that could significantly damage the structure disclosed therein.

Additionally, the first metal layer 704, the converter layer 708 and the second metal layer 712 have to be at a different electrical potential respectively (col. 11, lines 36-40). Arranging the Danielsson et al. converter layer 708 on either of the first metal layer 704 or the second metal 712 would not allow the different electrical potential on the three layers. Rather, by arranging the metallic converter layer 708 on one of the two metal layers 704, 712 the converter layer 708 and the respective metal layer 704 or 712 would certainly be at the same electrical potential.

To summarize, starting from Danielsson et al., the person skilled in the art would not take into account the teaching of Sauli because both documents relate to different physical applications and because the disclosure given by Sauli could not be used to improve the Danielsson et al. patent for the above-described physical reasons. A person skilled in the field of the applicant's invention would not think to use the Sauli device that detects low energy particles or radiation in a Danielsson et al. detector for detecting high energy x-rays. The picking and choosing of components and then rearranging those components without some motivation is in improper application of 35 USC 103.

XI. Conclusion

For the reasons set forth above, the Final Rejection should be reversed and the claims should allowed.

Respectfully submitted,

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Date: July 18, 2005

APPENDIX

1. A detector for detecting electrically neutral particles, having

a detector housing which at least in certain regions is filled with a counting gas,

a multiplicity of converter devices arranged in cascade form in the detector housing for generating conversion products as a result of the absorption of the neutral particles which are to be detected, the conversion products generating electrically charged particles in the counting gas, each of said converter devices comprising an insulator layer having opposite first and second surfaces, a first conductive layer and a second conductive layerdisposed respectively on the first and second surfaces of the insulator layer such that the first and second conductive layers are electrically insulated from one another by the insulator layer, and at least one converter layer arranged on at least one of the first conductive layer and the second conductive layer to define an outermost part of the respective converter device,

at least one readout device for detecting the electrically charged particles,

at least one electrical drift field device for generating an electrical drift field for the electrically charged particles in at least a region of the volume of the counting gas in such a manner that at least some of the electrically charged particles drift toward the readout device, the converter device being of charge-transparent design and being arranged in the detector housing in such a manner that the drift field passes through at least part of the converter device.

2. The detector as claimed in claim 1, in which the converter device has a multiplicity of passages, for the electrically charged particles.

3. The detector as claimed in claim 2, in which the passages have a minimum diameter of between 10 μm and 1000 μm, and a minimum spacing of 10 μm to 500 μm.

5. The detector as claimed in claim 1, in which a region of the converter device which is active in the conversion is arranged substantially perpendicularly in the drift field.

6. The detector as claimed in claim 1, in which the device for generating a drift field has a structured drift electrode to generate the drift field between the drift electrode and the readout device.

8. The detector as claimed in claim 1, in which the first conductive layer and the second conductive layer are electrically connected to a device for generating a converter field.

9. The detector as claimed in claim 8, in which the converter layer is a neutron converter layer which contains at least one of lithium-6, boron-10, gadolinium-155, gadolinium-157 and uranium-235.

10. The detector as claimed in claim 9, in which the converter layer has a layer thickness of from 0.1 μm to 10 μm, the first and second conductive layers have a layer thickness of from 0.1 μm to 20 μm, and the insulator layer has a layer thickness of from 10 μm to 500 μm.

11. A converter device for a detector for detecting electrically neutral particles, the converter device having an insulator layer with opposite first and second surfaces, a first conductive layer and a second conductive layer disposed respectively on the first and second opposite surfaces of the insulator layer such that the first and

second conductive layers are electrically insulated from one another by the insulator layer arranged between them, and at least one solid converter layer which is arranged on at least one of the first conductive layer and the second conductive layer, the converter device having a multiplicity of passages for electrically charged particles.

12. The converter device as claimed in claim 11, said at least one solid converter layer contains a neutron converter material selected from the group consisting of lithium-6, boron-10, gadolinium-155, gadolinium-157 and uranium-235.

13. A method for producing a converter for a detector for detecting electrically neutral particles comprising the following steps:

providing a plurality of insulator layers, each said insulator layer having opposite surfaces and two electrically conductive layers disposed respectively on the opposite surfaces of each respective insulator layer, so that the electrically conductive layers are electrically insulated from one another, each said insulator layer and the electrically conductive layers adjacent thereto defining a converter device;

providing a converter layer arranged on at least one of the conductive layers of each said converter device; and

arranging a plurality of the converter devices in a cascade form.

14. A detection method for detecting electrically neutral particles comprising the following steps:

trapping the electrically neutral particles which are to be detected using a plurality of converter devices arranged in a cascade form for generating conversion products when the neutral particles are absorbed, each said converter device having an insulator with two opposite surfaces, two electrically conductive layers disposed

respectively on the opposite surfaces of the insulator so that the electrically conductive layers are electrically insulated from one another, a converter layer being provided on at least one of the conductive layers of each said converter device;

generating electrically charged particles in a counting gas by means of the conversion products;

diverting the electrically charged particles in an electrical drift field to a readout device, at least some of the electrically charged particles being passed through the converter devices through a multiplicity of passages, which are arranged in the form of a matrix, in the converter devices; and

detecting the electrically charged particles in the readout device.